

# EXHIBIT C



**DEREK A. KING, M.S., P.E.**  
**Mechanical and Electrical Engineer**

## **SUMMARY**

Prior to joining Berkeley Engineering And Research, Inc., Mr. King was an assistant engineer for Lawrence Berkeley National Laboratories and was responsible for data collection, programming, and system testing for the analysis of energy loss in residential hot water systems. Mr. King's broad engineering work with BEAR has played an integral role in developing his expertise in applied research, machine design, prototyping, failure analysis, and both destructive and non-destructive testing. His dynamic problem-solving abilities continue to assist BEAR's Principal Engineers with damage assessment and complicated incident investigations. In 2015, he was promoted to "expert" to lead cases focused on product design failures as well as consulting for the oil and gas industry. His education in the field of mechanical engineering has been enhanced in 2020 by receiving a Masters Degree in electrical engineering. Additionally, he manages the BEAR college internship program. He is also a registered professional engineer in the State of California.

## **SELECT INDUSTRY EXPERIENCE**

Oil & Gas Industry, Construction, Manufacturing, Failure Analysis, Consumer Products, Automotive, Recreational Equipment, Lithium-Ion Batteries, 3D Scanning, Machine Shop, Pipeline Failure, Pressure Vessels, Analog Circuits, Programming, Site Inspections, R&D Projects, Prototyping

## **EDUCATION**

M.S in Electrical Engineering from Ohio University  
 B.S. In Mechanical Engineering from U.C. Berkeley

## **PROFESSIONAL EXPERIENCE**

### **2009 – present**

*Mechanical & Electrical Engineer* - Berkeley Engineering And Research, Inc.  
 Engineering Research, Design and Failure Analysis, Programming, Inspection Services

Mr. King has over 10+ years of experience identifying the root cause of failures and creating innovative and targeted solutions. He regularly designs and prepares experiments for automotive, consumer products, and other applications to aid in failure analysis. His skills include ISO & Safety Compliance for the Gas & Oil Industry, design and fabrication, and technical justification for design decisions and expert opinions. His responsibilities include subsequent data and error analysis and the iterative process of refining experimental parameters and comprehensive documentation. He manages BEAR contracts with Chevron, Phillips66 and Marathon Oil to provide onsite inspections by collecting laser scan data of coke drums at oil refineries, performing data analysis, applies ASME Boiler and Pressure Vessel code, and assisting with programming solutions. He provides machine shop and engineering for the BEAR team to aid in destructive and non-destructive field testing, and maintains a proprietary software library.

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# Expert Report

*In Reference to:*

**Wadsworth v. Jetson et al**

by

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Berkeley Engineering and Research, Inc.  
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## 1.0 Summary

On February 1<sup>st</sup>, 2022, a fire at the Wadworth home began at approximately 4 am. Several fire scene investigators identified the origin as the Jetson hoverboard (see **Figure 1**, below). These include Assistant Fire Chiefs Robinson and Erdmann, and Detective Sheaman.<sup>1</sup> One investigator, Ms. Cristal Van Dongren, expressed that she couldn't rule out that a fire started outside the bedroom window, while a fifth investigator also concluded that the origin was the Jetson hoverboard.<sup>2</sup>



*Figure 1: The remnants of the subject Jetson hoverboard.*

Subject and exemplar board inspections confirm that the Jetson hoverboard uses Lithium-Ion batteries. These batteries are a known fire hazard, and UL Standard 2272 was developed to help address this hazard in devices such as the subject board.

Detailed examination of the subject board shows that two out of ten cells exploded while the other eight cells show heat damage. Exploding cells are consistent with an internal short, thermal runaway, and vaporization and ignition of the liquid electrolyte.

## 2.0 Qualifications

Mr. Derek King holds an M.S. degree in Electrical Engineering from Ohio University, and a B.S. degree in Mechanical Engineering from the University of California, Berkeley.

<sup>1</sup> Sweetwater County Sheriff Report, Incident S22-01535.

<sup>2</sup> Call notes from Angela Kelsey-Flowers regarding Ms. Van Dongren and Mr. Schulz home inspections.

From 2009 to the present, he has worked as an engineer for Berkeley Engineering and Research in the areas of failure analysis, design, and risk assessment of consumer and industrial equipment, including personal electric transportation devices.

### 3.0 Materials Reviewed

- Subject and exemplar Jetson hoverboards
- Photos of injuries
- Photos of the fire scene
- Written statements and reports from investigators.
- Depositions of Sam Husain and Coryn Kremers

### 4.0 Fire Scene Investigation

BEAR was not directly involved in the fire scene investigation but was provided with the Sherriff Report for this incident and inspection photos of others. The Sherriff Report describes that Fire Chief Robinson, Chief Erdmann, and Detective Sheaman independently arrived at the same origin determination at the location of the subject hoverboard. Another investigator, Mr. Schulz, also concluded the origin was at the subject hoverboard. Out of five investigators, only Ms. Dongren felt she couldn't rule out a fire from outside the bedroom window.



*Figure 2: The bedroom window where the subject hoverboard was found.*





*Figure 3: Interior wood studs in the bedroom/hallway wall show preferential consumption from fire pointing towards the subject board location ("V-pattern").*



*Figure 4: The general location of where the wall V-pattern points. The wall above the subject board (circled) is completely burned away.*

Although the fire origin evidence will be analyzed by other experts, some observations can be made indicating the evidence is more consistent with an interior origin versus an origin outside the bedroom window:

- An exterior fire would have to rise along the wall, enter through the eaves, and then burn down to eventually reach the subject board. The exterior wall should therefore be exposed to the fire for the longest duration.
- The exterior of the house at and around the window area is substantially less fire damaged than the interior. The exterior wall studs are largely intact. This suggests a shorter and less intense exposure to fire on the outer wall compared to the interior.
- Detective Sheaman observed an interior V-pattern which included studs which were nearly completely consumed by the fire.

## 5.0 Subject Jetson Plasma Board

The subject Jetson Plasma was preserved from the fire scene and inspected. Visual inspection and CT scans were performed.



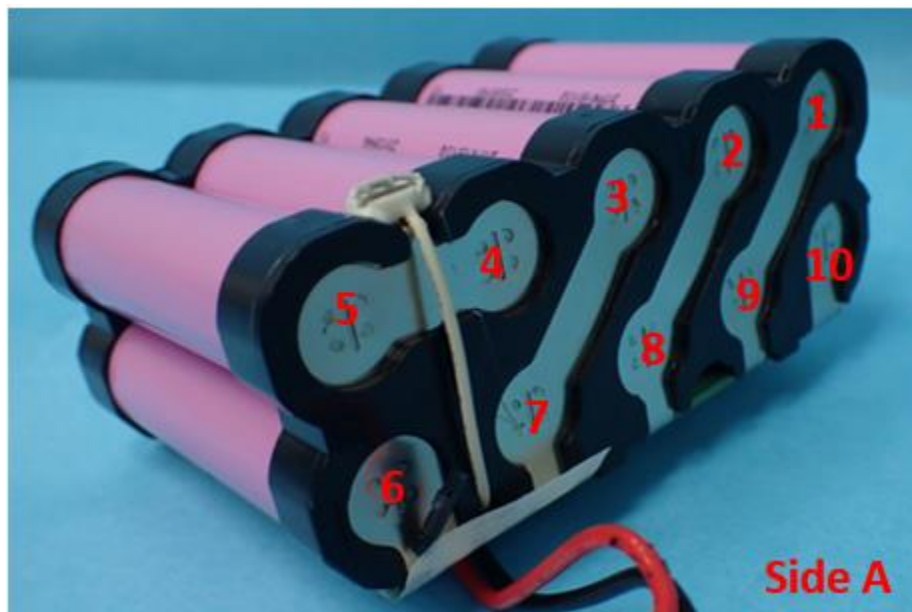


*Figure 5: The subject board as-received by BEAR. The wood plank appears to be added for physical support of the loose evidence.*

The evidence was compared with a disassembled exemplar. The combination of visual and CT scan data allowed the identification of the subject cells' original orientation.



*Figure 6: An exemplar board disassembled and oriented approximately the same as the evidence.*



*Figure 7: The exemplar battery pack with cells numbered for position reference. The pack with management board has asymmetric features that help identify subject cells.*



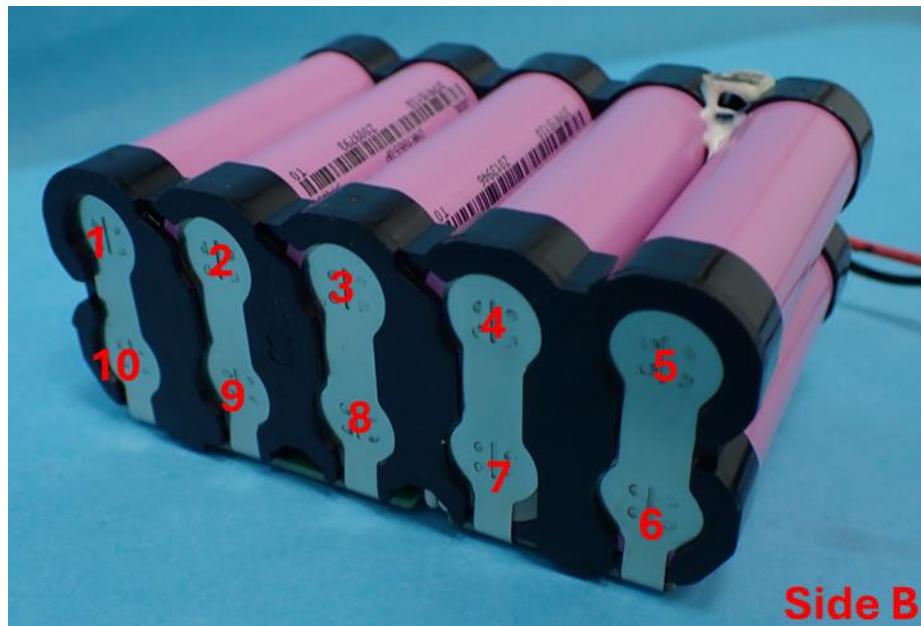


Figure 8: The other side of the exemplar battery pack with cells numbered for positional reference.

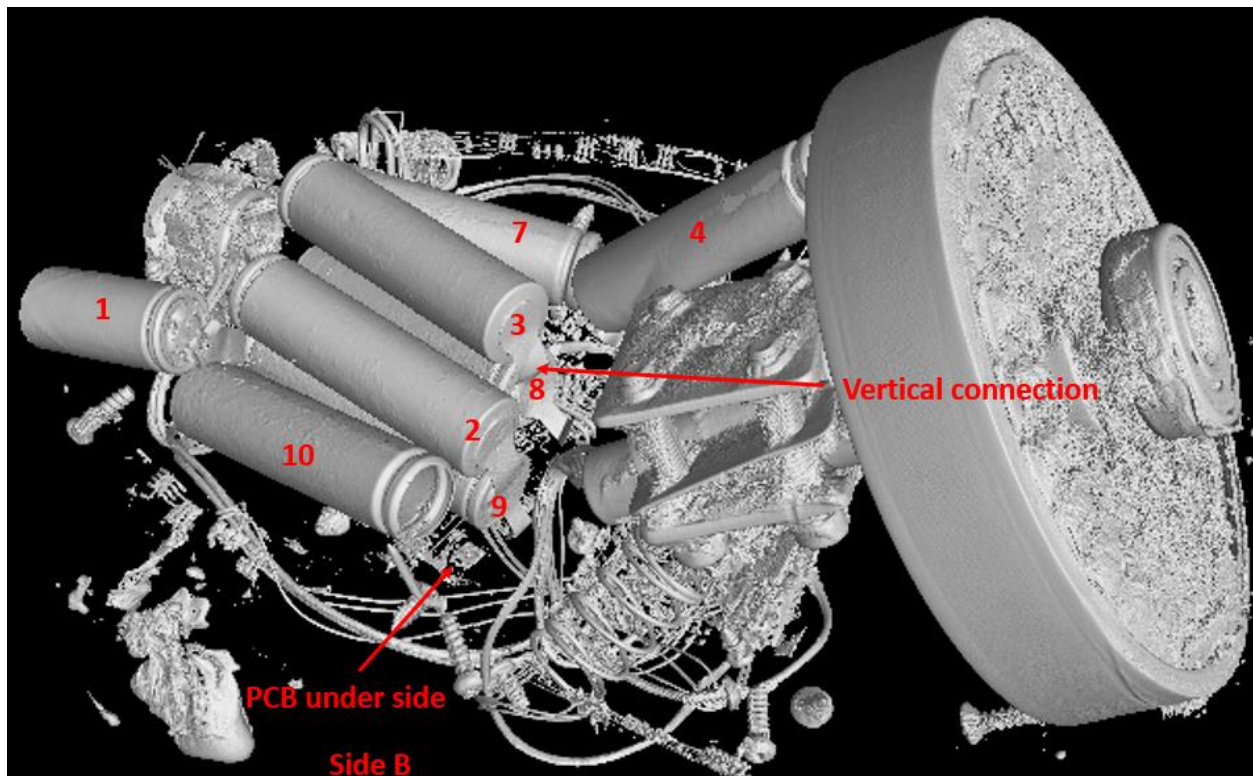


Figure 9: An example of using CT scan data to identify evidence cells' original positions.

All 10 cells were collected and inspected. Referring to the cell numbering in the exemplar pack, subject cells 4 and 10 have ruptured and expelled their contents, while the

remaining cells are largely intact. Based on BEAR's prior experience with testing lithium-ion batteries, including 18650, a ruptured cell is more consistent with an internal short resulting in a cell fire.

The difference in cell condition is consistent with cells 4 and 10 experiencing an internal short with thermal runaway and the other cells being damaged due to external heat. As shown in **Figure 7** above, cells 4 and 10 are diagonally opposite of each other within the battery pack – cell 4 is on the top and cell 10 is on the bottom. In addition to the rupture condition, the difference in the ruptured cell locations makes it unlikely that external heat would cause corresponding selective damage.

The subject board and model were certified to the UL 2272 standard. As noted by the CPSC in their hoverboard safety alert, certification to UL 2272 is not a guarantee against a battery fire hazard. The advice to not "...charge these devices unattended, especially overnight" is absent from the Jetson user manual.<sup>3</sup> When interviewed by Detective Sheaman, Mr. Wadsworth described that the children occasionally left the subject board plugged in for extended periods of time.

A more detailed root cause analysis may be performed after additional documentation has been provided for the Plasma board, battery pack, and battery cells (such as FMEAs, discussed below, product design documentation, and test reports).

## 6.0 Design, FMEA, and Risk Assessment

The design risk assessment method typically used for industrial equipment and consumer products is termed Failure Modes and Effects Analysis (FMEA). The method was developed in the 1940s by the U.S. Armed forces and formalized in 1949 with the introduction of Military Procedures document (MIL-P) 1629, "Procedures for Performing a Failure Mode Effect and Criticality Analysis." The objective of the method was to systematically list, rank, classify and assess failures according to their effect on mission success and the safety of personnel and equipment. It was later adopted by numerous industries and the Apollo Space Program in its efforts to put a man on the moon. In the late 1970s Ford Motor Company brought the FMEA method to the automotive industry in response to the safety and regulatory issues resulting from the Pinto affair.<sup>4</sup> In the 1980s, and 1990s, the FMEA method spread to industry equipment, consumer products (e.g. bicycles, computers, heat exchangers, etc.) and manufacturing systems and processes.

Once hazards or risks are known, the first and most desirable method in controlling the risk should be to design it out. The second method is to guard against the hazard, but only if the first method (design it out) is deemed unfeasible. The last and least desirable method is to

<sup>3</sup> Deposition of Sam Husain, pages 41 – 47, Exh 50, Exh 54.

<sup>4</sup> Kenneth W. Dailey, THE FMEA POCKET HANDBOOK at 8 (2004). Effective FMEAs, by C.S. Carlson, John Wiley & Sons, 2012.



educate the user against the hazard.<sup>5</sup>

This concept of first mitigating the hazard through design, then if that cannot be accomplished to mitigate through guarding, and only then if those both cannot be accomplished to mitigate via information has been formalized in the ISO Standard 12100 for machine design, and it shown in **Figure 10** below:

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<sup>5</sup> Handbook of System and Product Safety, by W. Hammer (Airforce and Hughes Aircraft Company Aeronautical Engineer), Prentice-Hall, 1972. Accident Prevention Manual for Industrial Operations, Nat. Safety Council, 7th Edition, 1974, p. 105. U.S Consumer Product Safety Commission, Central America Conference on Textiles Standards and Customs Procedures, June 23 – 24, 2015, by Frank J. Nava, Deputy Director, Field Operations. Implementing an Effective Product Safety and Liability Control Program, Seminar presented by SSS Consulting, Dayton, OH, November 5-7, 1979, Sponsored by the San Francisco Chapter, American Society of Safety Engineers.

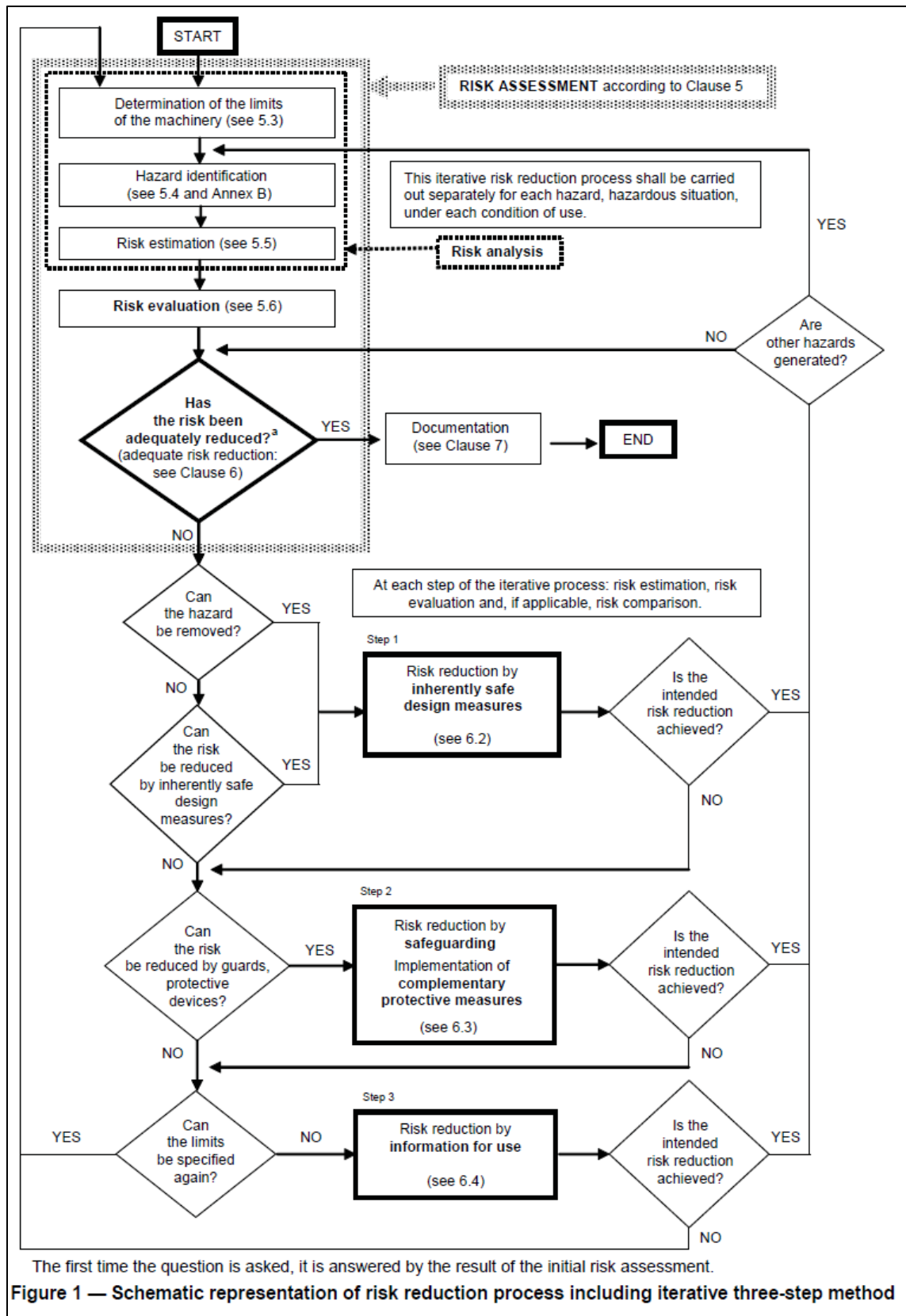


Figure 10: From ISO 12100, a risk assessment flow chart.

It is good engineering practice to perform such an analysis not just for machinery, but for any device that is intended to have an operator/user and can pose hazards for the operator/user.

Jetson should have conducted an FMEA or other Risk Assessment to eliminate unnecessary risks as part of their design process.

## 7.0 Conclusions and Opinions

These conclusions and opinions are provided to a degree of engineering certainty and are subject to change if and when new information becomes available.

1. Careful and prudent manufacturers and distributors of consumer products should perform competent FMEAs or similar risk assessments to eliminate or reduce potential dangers associated with their products. It appears unlikely that Jetson performed a competent risk assessment for the subject hover board.
2. Inspection and analysis of the subject board and cells indicates the ruptured cells were more likely caused by an internal short rather than external heating.
3. Internal cell shorting can result in cell fires which is consistent with other experts' findings of the fire origin at the subject board location.
4. The subject incident corresponds to the CPSC Safety Alert regarding the risk of hoverboard fires and leaving the board on the charger for extended periods of time.